

# SNOOPY:

## Student Nanoexperiments for Outreach and Observational Planetary inquiry

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*Angle of Repose of Martian Dust*

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*Contradistinctive Copper*

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&  
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São Paulo, Brazil  
*Spacesuit Materials for Mars*



# The Motivation

- **The first student experiments proposed to go to Mars.**
- **Involvement of students worldwide in the mission.**
  - Curricula to simulate the nanoexperiments using common materials and “kitchen chemistry.”
  - Immediate distribution of returned scientific data to the public for use in classrooms.
- **Prototype of small, self-contained experiments for future missions.**
  - Future competitions can be held for grade schools, undergraduate and graduate students.
  - Tiny “gas-can” type experiments may be proposed by the scientific community at large.

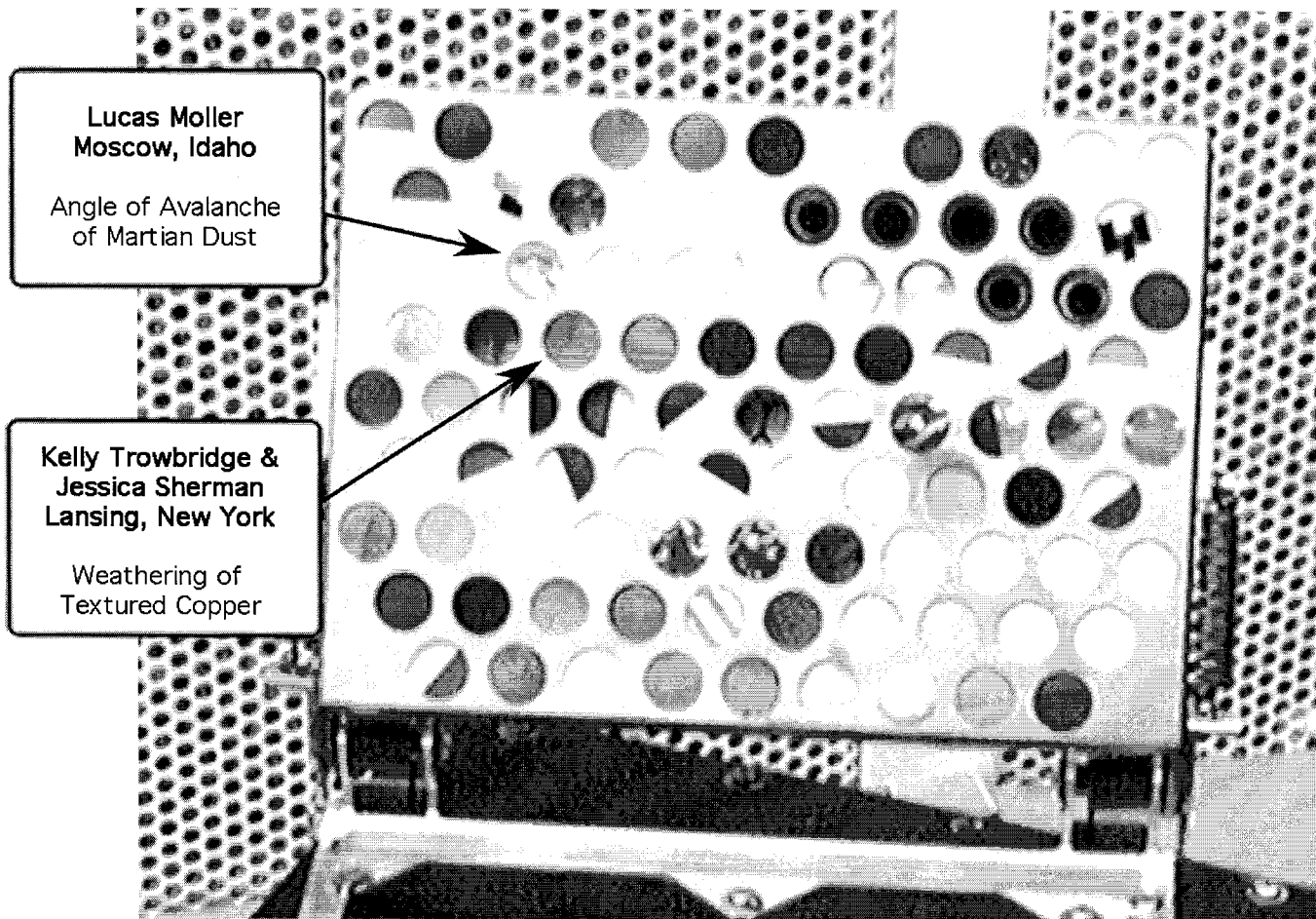


# The Nanoexperiment Challenge

- ↓ Conducted in partnership with The Planetary Society, the competition was open to pre-college students, up to 18 years of age, in teams of 1-3.
- ↓ Experiments were to:
  - ↓ Be consistent with MECA's Mission: To help us better understand how humans will be able to live on Mars.
  - ↓ Plug directly into the MECA Patch Plate.
  - ↓ Fit into a 1 cm diameter tube, 1 cm in height.
  - ↓ Have mass less than 3 grams.
  - ↓ Be fabricated from space-compatible materials.
  - ↓ Be observed only by the Robot Arm Camera.
  - ↓ Require no power or communications.
  - ↓ Contain no moving parts.
- ↓ Flight hardware was fabricated by Visionary Products Incorporated, and integrated into the MECA Patch Plate at JPL.



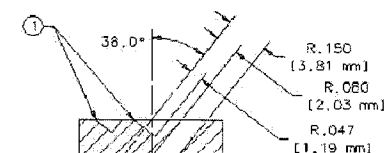
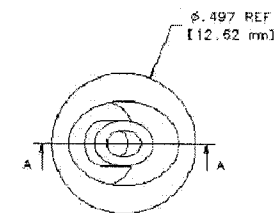
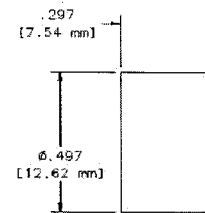
# The MECA Patch Plate



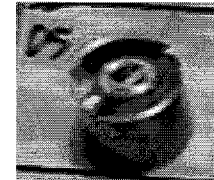
# Angle of Avalanche for Martian Dust

Lucas Möller  
5th Grade, Moscow, Idaho.

- ⌞ Addressed angle of repose questions posed at Mars 2001 Workshop.
- ⌞ Critical slope necessary for motion of the dust on a surface. (Angle of repose or static friction angle.)
- ⌞ Will print out copies of images and measure the tangent angles with a protractor.
- ⌞ Will compare these angles with results using sand, cement powder and other simulants.



ANGLE OF REPOSE EXPERIMENT



## NOTES

1. CUT TANGENT W/ TOP SURFACE
2. MATERIAL: AL 6061-T6
3. MATERIAL CERTS REQUIRED

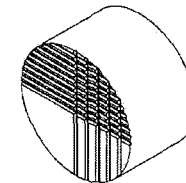
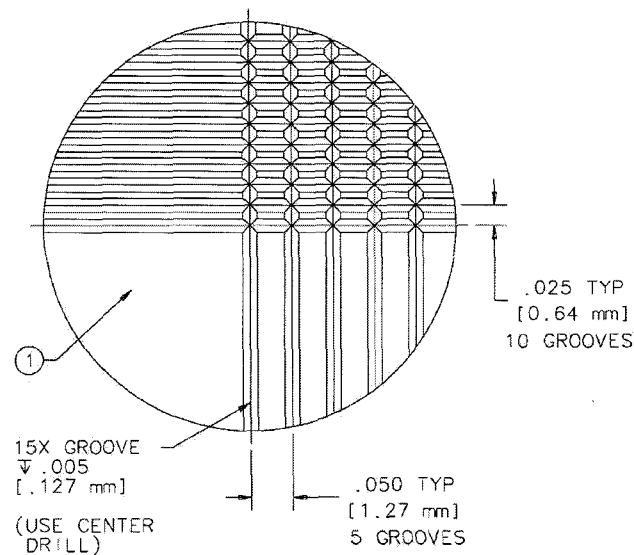


# Contradistinctive Copper

Kelly Trowbridge & Jessica Sherman,  
8th Grade, Ithaca, New York.

## Testing for:

- ↯ Corrosion properties.
- ↯ Oxidation properties.
- ↯ Temperature sensitivity.
- ↯ Dust deposition on different textures = different rates of corrosion and oxidation.

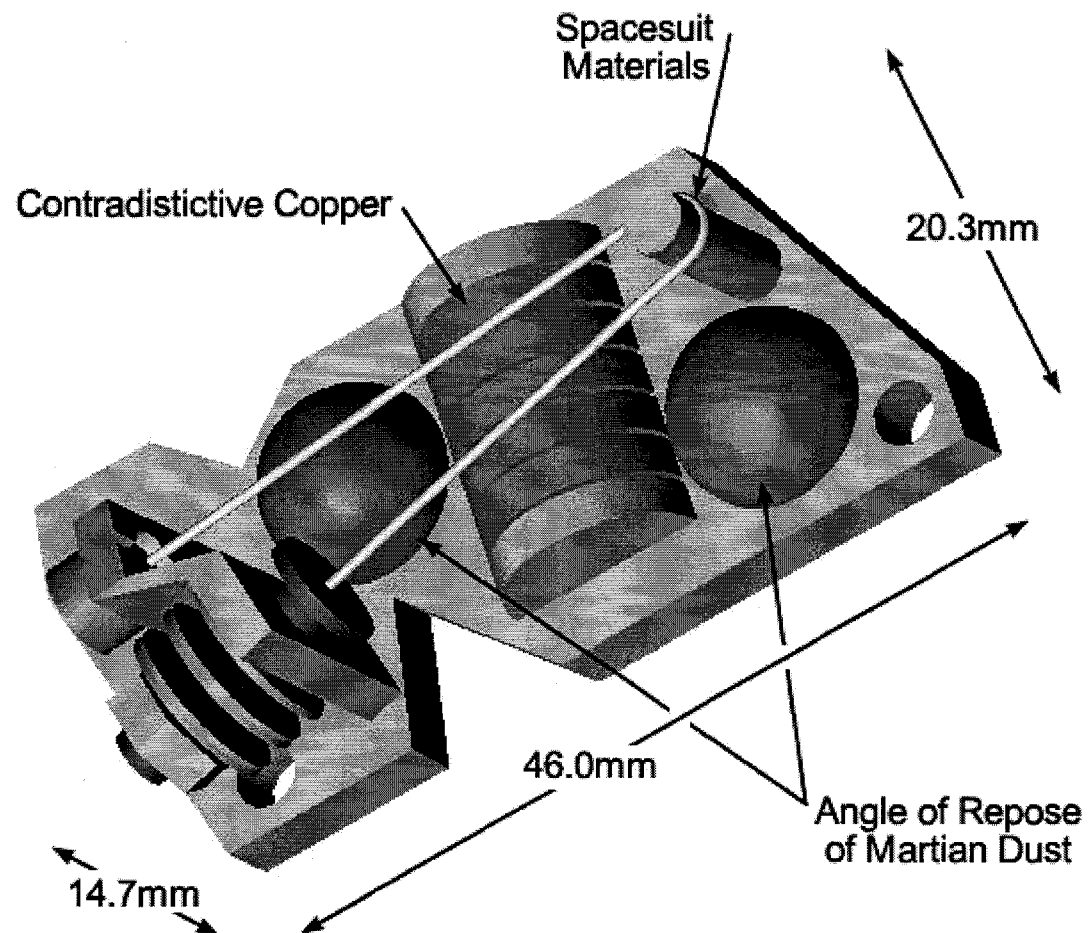


## NOTES

1. LAP SURFACE PRIOR TO MILLING GROOVES
2. MATERIAL: STOCK COPPER
3. MATERIAL CERTS. REQUIRED



# SNOOPY Payload



THE PLANETARY SOCIETY

THE UNIVERSITY OF  
**ARIZONA**  
TUCSON ARIZONA



**JPL**



# SNOOPY: Redesign of Experiments

## ➤ Angle of Repose:

- Eliminates dependence on landing angle of Beagle 2.
- Incorporates two materials, one insulating (Macor or alumina) and one conducting (aluminum) to see if accumulated charge has an effect on the angle of repose.
- Allows for easier viewing using the Beagle 2 camera.

## Contradistinctive Copper:

- ↖ Eliminates dependence on landing angle of Beagle 2.
- ↖ Provides range of textures through a spectrum of lighting conditions.
- ↖ Provides an *in situ* reference coated with Indium Tin Oxide





# SNOOPY Design: Spacesuit Materials

- ⌞ Combination of two proposed nanoexperiments.
- ⌞ Added since MECA. Although this was a finalist, there was not enough time to prepare this nanoexperiment to fly on MECA in 2001.
- ⌞ Kevlar fiber will be held under tension and exposed to the Martian environment.
- ⌞ Wear can be examined with the Beagle 2 stereo camera and possibly with the Beagle 2 microscope.
- ⌞ Failure of the Kevlar fiber will be easily seen by the Beagle 2 stereo camera. Creep of the Kevlar fiber will also be observed.



# Planned Outreach Activities

## *Student Nanoexperimenters*

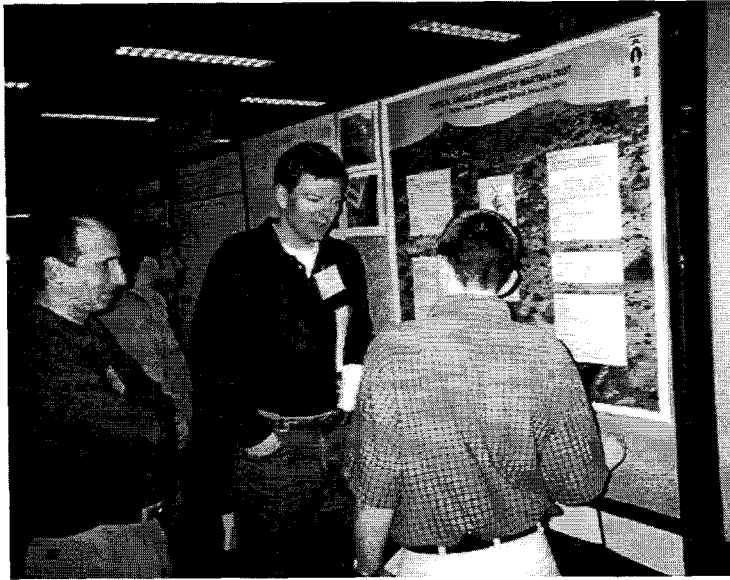
- Will provide science support of SNOOPY by calibrating their experiments.
- Will publish their results in the scientific literature and present them at the Lunar and Planetary Science Conference.

## *Students Worldwide*

- Curricular Materials for students to duplicate SNOOPY Nanoexperiments using common materials and equipment.



# Lucas Möller at 2001 LPSC



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